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ABSTRACT

This booklet is intended to serve as a basic guide for home economics teachers in adjusting classwork to the metric system. Reproducible student activity sheets constitute a major part of the publication. Teaching suggestions for introducing the metric system are given along with a discussion of the metric units. Also included are lists of student supplies and teaching material resources. (MN)

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Home Economics Teacher, North Junior High School, West Union, Iowa

At last we have something "down to earth" to help us, as teachers of Home Economics, to adjust our classwork to the metric system!

In the United States, the transition period into the metric way of life will be difficult and slow. Yet, come it will! On December 23, 1975, President Ford signed the U.S. Metric Act,

> "To declare a national policy of coordinating the increasing use of the metric system in the United States, and to establish a U.S. Metric Board to coordinate the voluntary adoption of the metric system."

Our profession needs to keep abreast of the times with everyday metric applications. This booklet can well serve as our basic guide.

Our author, Dr. Judy Oppert, is known to many Home Economics Education Association members. It was she who first produced for us the bibliography of authentic metric materials. That list was sent to all 1975-1976 members. Later, in Minneapolis on June 28, 1976, Dr. Oppert enthralled our members who assembled for annual meeting. From their enthusiasm, the idea for this publication was derived. We are appreciative of Dr. Oppert for her time and effort donated to our cause.

Your Home Economics Education Association officers hope each of you will experience the thrill of trying the author's creative ideas. We hereby grant permission to reproduce pages for classroom use as needed.

Leora N. Horning

Leora N. Horning, President
Home Economics Education Association

June 1, 1977

Dear Home Economics Teacher,

As our country and educational systems move toward metrics we find that we need to teach our students a new measurement language. It has a very small vocabulary, and the system is simple and logical. This booklet has been designed to help you teach the metric system of measurement.

The spellings, symbols, and terms used throughout this booklet are those recommended by the Department of Commerce at the time the booklet was written. These items may change as new decisions are made.

The symbol "SI" refers to the metric measurement system used in this booklet. In 1960 the metric systems in use around the world were reviewed, and a modernized version of the metric system was developed. This version is abbreviated SI for the French "Le Système International d'Unités." In the United States it is called the International System of Units.

I would like to express my appreciation to the people who helped to make this booklet possible. Leora N. Horning, HEEA President, and Cathie Leisher, HEEA Executive Secretary, suggested the idea. Alberta Dobry, HEEA President-Elect, graciously reviewed the manuscript as it was developed, and Hazel Taylor Spitze and the publications committee reviewed the booklet and offered valuable suggestions. Jane Frimml illustrated the student activity sheets and contributed much imagination and ingenuity. Many students have used the activity sheets and their reactions and comments were particularly helpful.

It has been fun and challenging to develop this metric booklet, and I hope you will enjoy using it. If you have questions, suggestions or comments, please write to me in care of HEEA.

Judy Oppert, Ed.D.

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TEACHING SUGGESTIONS

Do you remember using gram weights on the balance in chemistry laboratories? Did you measure liquids in graduated cylinders marked in milliliters? Was the thermometer calibrated so there were 100 degrees between melting and boiling? If so, you were using a form of the metric system.

The metric system is not new, but most home economics teachers have not needed to use it in their teaching. Now more people are using metric terms, more products are labeled in metric units, and more legislation suggesting or requiring the use of the metric system is being passed. The metric system is becoming a part of our lives.

Every student and every consumer in our country is going to need to learn the metric system. This is a marvelous opportunity for us to reach many people in and outside of the regular classroom. Some consumers have already recognized the need to learn metrics and many more will in the weeks and months ahead. Are we ready to teach them metrics and the related aspects of consumer education?

Theory

Learning the metric language of measurement is similar to learning a second language. Many of the same principles apply. For instance, the student is encouraged to learn the metric terms and quantities they refer to rather than converting the metric terms back into customary measurement units. The student learns that a centimeter is approximately the distance across his/her little fingernail rather than an inch equals 2.54 centimeters. Perhaps you have seen the slogan, "Think Metric." We are referring to this concept of learning the metric system rather than converting between the customary and metric systems of measurement. It is well worth the effort since metric will gradually become our primary system of weights and measures over the next several years

Many other countries have adopted, or are in the process of adopting, the metric system of measurement. From their experiences we know that people learn the metric system by measuring with metric measuring tools and using metric units. Students are not able to learn a new language of measurement by listening to lectures. Many authors use the terms "hands on" or "activity based" to describe this student involvement strategy. The student activity sheets included in this booklet are designed to involve the student in activities and experiences with metric measuring tools and metric units.

Students will find it easier to learn the metric system if they do not have to switch back to the customary system of measurement. Make your classroom a "metric world" and use the metric system in all activities. Encourage your students and help them gain self-confidence in working with metric units so they will use metrics outside of the classroom. The students can help to educate their parents and other adults in the school and community. Use of metric measurement in the home and community reinforces the classroom activities and aids learning and retention.

Ideas for Introducing the Metric System

You are the best judge of your student's present knowledge and attitudes toward the metric system. The following ideas and suggestions are included for introducing the metric system. Hopefully these ideas will suggest additional techniques and strategies that will be particularly useful in your situation.

When introducing the metric system, your goals may include:

(1) developing an awareness of the metric system in the students,
(2) motivating the students to learn more about the metric system and its use in the U.S.A.,
(3) encouraging students to find out why we are adopting the metric system of measurement,

(4) exploring with students the advantages and disadvantages of the metric system, and
(5) minimizing fears about the change to metrics.

Suggestions

A. Ask students to find as many examples as they can of the use of metric units. You may wish to suggest they look on labels of products, read advertisements, listen to weather reports, look at order blanks for camera or movie film, read reports of Olympic sporting events, and/or talk to people from other countries.

During this activity students can also be asked to note when customary units are given with metric units and when metric units are used exclusively. It may be necessary for you to describe and define the metric system of measurement. Encourage students to note the measurement units, prefixes and decimals.

B. Have the students try to find as many equivalents for a customary unit of measurement as possible. For example, have students try to fill in the following blanks. (Answers are provided in the blanks.)

1 mile =	63 360	inches
	15 840	hands
	7 040	spans
	5 280	feet
	1 760	yards
	320	poles
	320	rods
	8	furlongs
	0.33	leagues(s)

(This chart may be written on a transparency, the chalk board or a work sheet.)

Point out that people do not know our customary measurement system. Ask the students if they can remember all these numbers. Is there another way? Can they devise another system of measurement? For example, choose a "dox" (or other mythical name) and develop a system of measurement. Then evaluate the proposed system. Does the system have numbers and units that are easy to remember? Is the system logical? Is there only one unit for each dimension (i.e., length, volume, weight or mass) to be measured? Is there a need for another system of measurement than our customary system? Does the metric system fulfill this need?

C. Review the history of measurement and discuss the basis for our customary units of of measure (articles found in nature or parts of the human body) and the reasons why other systems of measure have been proposed. You may wish to develop a "time line" showing when major changes have occurred in our measurement system. Students can research the long debate over measurement systems in our country and the changes in other countries.

In addition to an encyclopedia, references include:

ARITHMETIC TEACHER (periodical, April 1973 and May 1973)

BRIEF HISTORY OF MEASUREMENT SYSTEMS WITH A CHART OF THE MODERNIZED METRIC SYSTEM, Stock No. 0303-01073, $.30, from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

THE KILOS ARE COMING, 44 colored slides, script, resource list, guide, and activities, $20.00 prepaid to UVM Extension Service, from Mrs. Virginia Jodoin, 210 Terrill Hall, University of Vermont, Burlington, VT 05401.

D. Discuss the desirability of measuring items in similar units when exchanging or selling goods. When a bushel of potatoes is larger in one state than another, what effects does this have? If you wanted to sell a blouse or shirt constructed with inch measurements in a metric country, what problems would you have? What countries could you now sell the blouse or shirt in without any measurement problems? List as many countries as you can. Then refer to the world map of nonmetric countries in the appendix. (This map can easily be made into a transparency with the aid of a photographic copier.) Note: Some of the metric countries on the map are in the process of going metric and have not completed the process. In 1975, metric legislation was passed in the United States, encouraging a voluntary change over to the metric system. What problems will manufacturers in the U.S.A. have as more countries complete the metrication process? If you were a manufacturer, would you adopt the metric system of measurement? Why or why not?

E. Have students calculate two mathematics problems: one using customary units and the other using metric units. The differences are especially obvious when the size of an area is calculated. For instance, measure the perimeter of a room in customary units and metric units and ask the students to calculate the amount of flooring material needed to cover the floor. What measurement units were easiest to use and calculate?

Brainstorm or debate other advantages and disadvantages of adopting the metric system. Many of the metric publications contain information on this topic, and experiences with metric measurement suggest more ideas. Is it easier to double recipes with fractions or whole numbers? How expensive is it to change measurement systems? And so on.

Metric Measuring Tools

Metric measuring tools can be borrowed, made and/or purchased. Directions for making tools and addresses with ordering information are given in the next sections of this booklet.

When purchasing measuring tools, the buyer will want to note whether customary units are included on the measuring tool. When both metric and customary units are included, the learner tends to use the customary units rather than the metric units. Also, errors are made because one set of numbers is accidentally interchanged with the other scale. And the tools with dual scales will quickly become obsolete as we go metric. Research studies suggest that it is more efficient to change from a customary measuring tool to a metric measuring tool and skip the use of dual measurements.

The purchaser of tools and materials will find it advantageous to check the accuracy of these items. It is easy for measurement scales to become distorted during the printing process. For example, students are frustrated when centimeter rulers differ from centimeter graph paper when they are trying to use both items to draw a floor plan. It is equally frustrating to find a 250 milliliter measure differing from another measure by as much as 40 milliliters. It is suggested that tools for measuring length be carefully compared to tools from different sources to ascertain accuracy. Volume measuring tools can be checked by comparing them with a graduated milliliter cylinder from the science department.

Units of Length

The meter is the basis of many of the other measurement units in the metric system. Therefore, it is suggested that the students use the meter section of this booklet first. The teacher may wish to use this section as a demonstration or make multiple copies for student use. The other units of length logically follow and the students should be encouraged to use the centimeter, millimeter OR kilometer sections next.

Frequently meter sticks are available at school supply stores, department stores, hardware stores and lumber yards. They may be purchased now for $.95 each or 10 for $6.50 from:

Ideal School Supply Company
11000 South Lavergne Avenue
Oak Lawn, IL 60453

Students can make their own meter sticks. Scrap pieces of plywood or wood, 40 inches in length, can be cut at the lumber yard, in the industrial arts department, or by someone who is skilled in operating and has access to a power saw. The students can then use a purchased meter stick or tape measure as a guide and mark their meter stick into centimeter divisions.

Similarly, students can make tape measures from strips of oil cloth. It is easy to cut in straight lines if an oil cloth with a small pattern check is chosen. The student can cut along the pattern lines and mark the metric units on the reverse side.

Metric rules can be made from many materials. Poster board or "tag board" has been satisfactorily used.

Clothing construction projects utilize length measurements and can be used to teach metric length units. Teaching aids that can be purchased include:

EDUCATOR'S GUIDE TO METRIC FOR CLOTHING CONSTRUCTION, pamphlet, $.25 from:

Coats & Clark Inc.
Consumer and Educational Affairs Department
72 Cummings Point Road
Stamford, CT 06902

MEASURING METRIC IN FASHION SEWING, 35 mm film strip, audio cassette, teaching guide, $15.00 from:

The Education Department
The McCall Pattern Company
230 Park Avenue
New York, NY 10017

Units of Area

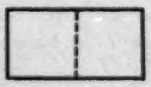
This section uses the information and two of the measurements from the Units of Length. It logically follows the length sections, and it is suggested that it be used after the sections on length are completed. Area is a particularly important concept in housing and interior design. The concept of volume builds on area, and the next unit on volume logically follows the Units of Area. In some learning situations, the teacher may choose to eliminate this section on area if the students will not be using the concept.

To help the students visualize the relationships between units of area, they can draw squares with each side measuring one centimeter, one decimeter (10 centimeters) and one meter. These squares can then be divided into smaller metric units. Some of the relationships that can be shown are:

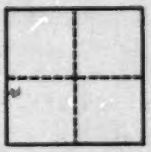
$1\ cm^2 = 100\ mm^2$
$1\ dm^2 = 100\ cm^2$
$1\ m^2 = 100\ dm^2$

A transparency can be made from centimeter graph paper (Appendix). The transparency can then be placed over a number of items to help students measure the areas of these items. The graph paper can also be used for drawing floor plans.

The students are cautioned to use the word "square" before the name of the measurement unit. They should say "two square centimeters" NOT "two centimeters square." (See illustration.)



Two Square Centimeters



Two Centimeters Square

Two square centimeters is an area of that size, as shown on the left in the illustration. The phrase "two centimeters square" describes a square that measures two centimeters on each side and has an area of four square centimeters.

The hectare unit, introduced in this section, has been approved for use with SI units. Hecto is a prefix, and it indicates that the unit is multipled 100 times. An are (pronounced air) is a unit of area that was part of an obsolete version of the metric system. An are contains 100 square meters, and an average house would have an area of about two ares.

Units of Volume

The sections on liter and milliliter logically follow area. The units of volume are especially important in food preparation at this time.

It is generally agreed that most recipe ingredients will be measured in volume units. The trend is to measure all of the ingredients in milliliters and liters that we now measure in teaspoons, tablespoons, cups, pints and quarts. We may also measure the volume of baking and cooking utensils rather than the length dimensions. For example, a recipe may specify a three liter oblong cake pan rather than a 9 × 13 in. cake pan.

Liquid measures with metric units marked on one side are readily available in department and hardware stores. The metric markings have not been accurate on some measures. To check the accuracy of your measures, borrow a graduated cylinder from the science department and measure equal amounts of water or a similar substance. If you are on a limited budget, you may be able to borrow measuring tools from other departments for student use. Be sure the measures are clean if they are used for food preparation.

Dry volume measures are now available for purchase. The sizes that will probably be used in the United States are 1, 2, 5, 15, 25, 50, 125 and 250 milliliter measures. CAUTION: some companies are marketing metric measures that are merely conversions of our present dry measures. An advantage of using the metric system is that numbers are "round" or "even." The system is based on the number 10 and preferred numbers are 1, 2 and 5. Note the "even" numbers and use of the preferred numbers in the sizes of dry measures.

Dry metric measures can be ordered now from the following companies:

Five stainless steel measures (1, 2, 5, 15 and 25 mL), #02-003,$1.75 and three stainless steel measures (50, 125 and 250 mL), #02-004, $2.50 (school prices), from:

Metric Shop
Box 392
720 Cayuga St.
Lewiston, NY 14092

Five plastic measures, #80350, $.75 and three plastic measures, #80340, $1.50 (sizes same as previous), from:

Ohaus Scale Corporation
29 Hanover Road
Florham Park, NJ 07932

Students can make their own liter measures. Half-gallon milk cartons can be filled with a liter of water and marked to indicate the liter measure. The cartons can be cut off about a centimeter above the liter mark to measure liquids. Cans can also be filled with a known quantity and marked to make a metric measure. Decimeter cubes can also be purchased or constructed from cardboard. Use a plastic bag liner inside the cubes so students can fill them with water.

Additional resources relating to food preparation are available. They include:

HANDBOOK OF FOOD PREPARATION. $4.00
American Home Economics Association
2010 Massachusetts Ave. NW
Washington, DC 20036

Darling, Mary. METRICS IN THE KITCHEN. Extension Folder 294-1974.
University of Minnesota
Agricultural Extension Service
St. Paul, MN 55108

COOKING THE METRIC WAY: AN EASY GUIDE TO GOOD NUTRITION (recipe book), $3.00
BCHEA Metric Cookbook
2268 Kensington Ave.
Burnaby, British Columbia V5B 4E2

AMERICAN METRIC BEEF COOKBOOK, $2.50
Beef Industry Council
444 North Michigan Avenue
Department BOOKS
Chicago, IL 60611

METRIC IN THE KITCHEN, 35 mm film strip, teacher's guide, wall chart, 30 student leaflets, oven temperature sticker, $35.00
General Mills Canada, Ltd.
P.O. Box 505
1330 Martin Grove Road
Rexdale, Ontario M9W 4X4

Oppert, Judy. "Metric Recipes for Classroom Use," ILLINOIS TEACHER OF HOME ECONOMICS, January/February 1977, XX (3), 131-133.

Many people use the terms "volume" and "capacity" interchangeably as this teaching aid does. Technically, volume is the cubic size. For example, a cubic centimeter is a measurement of volume and the cubic centimeter has a capacity of a milliliter. Milliliter and liter are measures of capacity; and cubic centimeters, cubic decimeters, and cubic meters are measures of volume.

Three symbols have been used for liter. These symbols include a small, cursive ℓ, capital L, and small l. The international symbol is the lower case l; and the U.S. Department of Commerce is recommending the capital L to avoid confusion with the numeral one (1).

Many people have difficulty estimating volume. A small change in the dimensions of a container can make a large difference in its capacity. Therefore, estimation was not stressed in the sections on volume. You may wish to encourage your students to develop estimation skills in this area, and you may add additional exercises for this purpose.

Units of Weight or Mass

In the metric system the units of length, volume and weight or mass are related. It will be easier for the students to learn this concept if the sections are presented in order: (1) length, (2) volume, and (3) mass or weight.

Perhaps a kilogram scale can be borrowed from the school nurse, or some stores are selling kilogram bathroom scales. A scale can be ordered. One available now is #80440, $12.50, from:

Ohaus Scale Corporation
29 Hanover Road
Florham Park, NJ 07932

Gram scales are frequently sold in local stores and shops specializing in cookery and/or diet items.

Students can construct a balance and use it to compare the weight of various items. Hang a coat hanger from a door knob, nail, or other support. Attach fish line or strong string to each end of the hanger. Hooks or plastic coffee can lids can be tied to the end of both lines. Items can then be attached to the hooks or set on the lids.

At this time people are debating whether the term "weight" or "mass" should be used as we go metric. Weight is the amount of gravitational attraction of the earth on an object. The weight of a man changes as he gets closer to the moon. Mass is the amount of matter in an object, and it does not change in space. The U.S. Department of Commerce says that "weight" is synonymous with "mass."

The kilogram is the only base unit in common use that contains a prefix. The gram is too small to be useful for everyday use, so the kilogram has been designated as the base unit.

Degree Celsius

Celsius is the name of the man who is given credit for developing the centigrade temperature scale. The Celsius and centigrade temperature scales are identical, but we will use the term Celsius for the temperature scale. (The term centigrade is being used for some angle measurements, and to avoid confusion, it will not be used with temperature.)

Scientists use a temperature scale called kelvin. It goes down to absolute zero, and it also has one-hundred degrees between freezing and boiling. On the kelvin scale ice melts at 273 K and water boils at 373 K. The size of a degree on the kelvin and Celsius scale is identical.

Students can construct a Celsius scale for existing thermometers and thermostats. They can locate and label the freezing and boiling points on the thermometer and divide the space between into 100 equal degrees. We know that body temperature is 37°C so it should be at 98.6° on the old scale. Similarly, a Celsius scale can be constructed for the oven. These scales may need to be removed if other people who have not learned the metric system use the facilities.

Thermometers that measure from − 30°C to 50°C can be ordered.

Specify #5556, 10 for $4.00, from:

Ideal School Supply Company
11000 South Lavergne Avenue
Oak Lawn, IL 60453

Student Supplies

The student will need measuring tools and other materials to complete many of the sections. The supplies needed are listed by sections below.

Meter, Centimeter, Millimeter and Kilometer (Units of Length)

1. meter stick
2. pencil
3. yard stick or tape measure marked in *inches*
4. tape measure marked in *centimeters*
5. ruler, tape measure or meter stick marked in *millimeters* (may be the same meter stick and tape measure listed above—1 and 4)
6. paper clip
7. map with kilometer scale (a scale can be constructed for a map with 1 kilometer = 0.621 miles and 5 kilometers = 3.107 miles)

Units of Area

1. a tape measure or ruler marked in centimeters
2. pencil
3. postage stamp, dollar bill and envelope

Liter and Milliliter (Units of Volume)

1. 0.5 or 1 liter volume measure
2. pencil
3. water to measure
4. half-gallon milk carton

5. quart milk carton or measure
6. centimeter measure
7. small measures (1, 2, 5, 15, 25 mL)
8. teaspoon measure
9. 250 mL liquid measure
10. containers such as a glass, cup, bowl

Kilogram, Gram and Milligram (Units of Weight)

1. kilogram bathroom scale
2. pencil
3. liter of water
4. pound of butter, coffee, or other food
5. gram scale
6. milliliter of water
7. nickel, paper clip and so on
8. labels containing gram symbols
9. labels containing milligram units (nutrition labels and pharmacy items)

Degree Celsius (Temperature)

1. Celsius thermometer
2. pencil
3. ice, water, refrigerator and so on

Resources for Teaching Materials

The following resources contain teaching materials, ideas, and information about the metric system.

Anderson, Ruth. METRICS: A RESOURCE GUIDE FOR HOME ECONOMICS (available through ERIC in near future), microfiche, PA-051-535,
VEIN
Stayer Research and Learning Center
Millersville State College
Millersville, PA 17551

AN EDUCATOR'S GUIDE TO TEACH METRICATION
Consumer Information Services - D/703
Sears, Roebuck and Co.
Sears Tower
Chicago, IL 60684

Henry, Boyd. TEACHING THE METRIC SYSTEM, $1.50
Weber Costello
1900 N. Narragansett Ave.
Chicago, IL 60639

THE INTERNATIONAL SYSTEM OF UNITS (SI), NBS Special Publication 330, $.65,
Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402

METRICS FOR BEGINNERS, 8 color photo-posters, #522, $4.95
Instructor Publications, Inc.
Instructor Park
Dansville, NY 14437

A PARENT'S GUIDE TO HOMEWORK (METRIC), $.50
Winston-Salem/Forsyth County Schools
P.O. Box 2513
Winston-Salem, North Carolina 27102

PRACTICE IN METRICS FOR BEGINNERS, 20 duplicating masters, #845, $4.25
Instructor Publications, Inc.
Instructor Park
Dansville, NY 14437

SI...A METRIC WORKBOOK FOR TEACHERS OF CONSUMER AND HOMEMAKING EDUCATION, $1.50 prepaid, contains transparency masters
Orange County Department of Education
1300-B South Grand Avenue
P.O. Box 11846
Santa Ana, CA 92711

SOME REFERENCES ON METRIC INFORMATION AND ALL YOU WILL NEED TO KNOW ABOUT METRIC (FOR YOUR EVERYDAY LIFE), chart which may be reproduced, NBS LC 1970
Metric Information
National Bureau of Standards
Washington, DC 20234

Two organizations have developed a variety of metric materials. You may wish to contact them and ask for publications in your area.

Cooperative Extension Service
(office generally located in county seat)

Metric Commission
320 Queen Street
Ottawa KIA OH5

Catalogs of metric measuring tools are available from the following companies:

Dick Blick
P.O. Box 1267
Galesburg, IL 61401

Ohaus Scale Corporation
29 Hanover Road
Florham Park, NJ 97932

Ideal School Supply Company
11000 South Lavergne Avenue
Oak Lawn, IL 60453

Sargent-Welch Scientific Company
7300 North Linder Avenue
Skokie, IL 60076

Selective Educational Equipment (see), Inc.
3 Bridge Street
Newton, MA 02195

General Information

The following chart shows the metric prefixes in common use and the combinations with metric units.

METRIC PREFIXES

Prefix	Quantity	Length	Volume	Weight (Mass)
Kilo-	× 1000	*kilo*meter	*	*kilo*gram
		METER	LITER	GRAM
Cent:	÷ 100 (0.01)	*centi*meter	*	*
Mill:	÷ 1000 (0.001)	*milli*meter	*milli*liter	*milli*gram

*not commonly used

When recording measurements we use decimal notation. Stress the decimal nature of the system and avoid the use of fractions. Write fractional terms in decimal form.

In the United States we indicate a decimal point by writing a dot on the line. Some countries use a comma, and others use a raised dot. We will not use commas to separate groups of digits and, thus, we will avoid confusion with the decimal comma in materials from other countries. We will separate groups of digits into groups of three and separate the groups with a space. Example: 456 530.893 67 If there are only four digits to the left or right of the decimal and the numbers are NOT in a list, the space is optional. Example: 1000 or 1 000

Measurement is approximate. When recording measurements we want to avoid unnecessary precision. There is no need to include additional numbers when they give a false impression of accuracy or if they have no purpose. For example, a waist measurement might be recorded as 57 centimeters but not 578 millimeters.

Have you read about the "soft" and "hard" changes that are taking place as we go metric? A soft change is the conversion of the customary measurement units to metric units. For example, a small can of vegetable juice would be labeled 156 milliliters. A hard change refers to a change in the hardware used to produce and/or package the product. Hard changes usually refer to changes in the size, weight, and/or other dimensions of the product. After hard conversion occurs the small can of vegetable juice might measure 200 milliliters.

Finally, be positive as you adopt the metric measurement system. Let's encourage everyone to learn more about the metric system and to use it. Self-confidence needs to be built, not destroyed. We all make errors! Every consumer will need to learn metrics, and home economists can fill this need better than any other group of professionals. Let's begin now!

Uses of the Activity Sheets

This booklet is designed to help you teach the metric system through activity-based experiences. You may copy the activity sheets for student use. The activity sheets are divided into 12 sections and each section is devoted to one topic. Each section contains objectives, activities, and answers. These sheets can be duplicated by means of a photographic copier. By placing the measuring tools and supplies in a folder, box or other container and attaching the activity sheets for the particular unit of measurement, you can make a packaged unit that can be used individually, in small groups, or as part of general classroom activities. If the student needs to use materials that are not with the folder or container, please write in the location of the materials so the student can easily find them.

The activity sheets are designed so you can add color, cartoons and your own creative ideas. The materials have been designed for easy addition of new items or removal of those items that are not appropriate. Suggestions for additions include pre and post tests, metric games, the history of the metric system, ideas for teaching metrics to others and news articles about metrics. Students also could be encouraged to design additional learning activities.

You may wish to fill in some of the blanks on the answer sheets pertaining to your situation before duplicating, e.g., question 5 under meter is the length and width of *your* classroom.

All You Will Need to Know About Metric

(For Your Everyday Life)

10

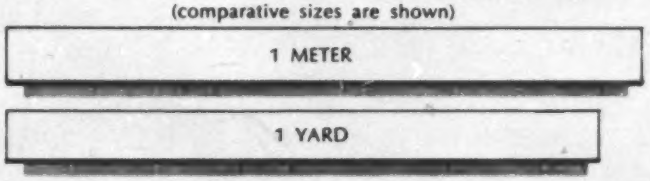
Metric is based on Decimal system

The metric system is simple to learn. For use in your everyday life you will need to know only ten units. You will also need to get used to a few new temperatures. Of course, there are other units which most persons will not need to learn. There are ever some metric units with which you are already familiar: those for time and electricity are the same as you use now.

BASIC UNITS

METER: a little longer than a yard (about 1.1 yards)
LITER: a little larger than a quart (about 1.06 quarts)
GRAM: about the weight of a paper clip

(comparative sizes are shown)



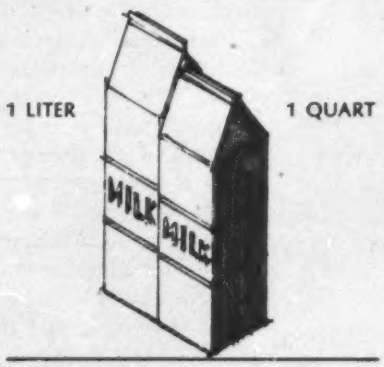
25 DEGREES FAHRENHEIT

COMMON PREFIXES

(to be used with basic units)

Milli: one-thousandth (0.001)
Centi: one-hundredth (0.01)
Kilo: one-thousand times (1000)

For example:
1000 millimeters = 1 meter
100 centimeters = 1 meter
1000 meters = 1 kilometer



1 LITER 1 QUART

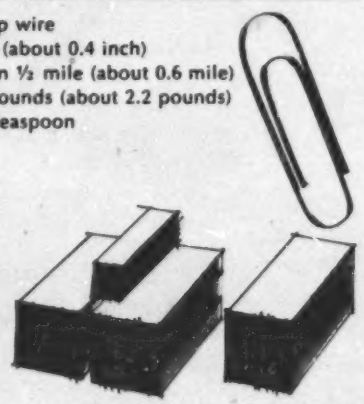
25 DEGREES CELSIUS

OTHER COMMONLY USED UNITS

Millimeter:	0.001 meter	diameter of paper clip wire
Centimeter:	0.01 meter	width of a paper clip (about 0.4 inch)
Kilometer:	1000 meters	somewhat further than ½ mile (about 0.6 mile)
Kilogram:	1000 grams	a little more than 2 pounds (about 2.2 pounds)
Milliliter:	0.001 liter	five of them make a teaspoon

OTHER USEFUL UNITS

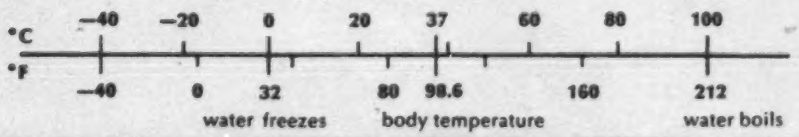
Hectare: about 2½ acres
Tonne: about one ton



1 KILOGRAM 1 POUND

TEMPERATURE

degrees Celsius are used



For more information, write to: Metric Information Office, National Bureau of Standards
Washington, D.C. 20234

Note: This chart may be reproduced

GAMES

Games can be an excellent vehicle for teaching metrics. The content of existing games can be modified to include the metric system, new games can be purchased, and students and teachers can devise new games.

The following game was developed by a graduate student when he was teaching metrics.

DOWN 'N' BACK
by
Terrel C. Trotter, Jr.

Each player needs his own meter stick and a token marker. A pair of special dice are also needed. One die is marked with the numbers 5, 10, 15, 20, 25, and 30, while the other has "cm" and "mm."

Here are the rules:

1. Place the meter sticks side-by-side with each player's marker at the "zero" end of his stick.
2. Decide which player will start the game, and how play will rotate for each player's turn.
3. At his turn, each player will toss the dice and move the distance along his meter stick that is indicated by the number and unit showing. For example, a "10" and a "cm" means to move that player's marker "10 cm."
4. The winner of the game is the first player to move his marker *down* the meter stick and *back* to his starting point.

There are two special cases that the players should decide on before the game begins.

1. The Turn Around Case:
   When a player is ready to make the "turn around," he can be required to (a) "step off" the stick when the distance shown by the dice is greater than the distance remaining to the end of the stick; he then gets back on with his next turn and continues back; or (b) he uses just what is necessary to get to the end, using the remainder of the distance to immediately begin his return. For example, let a marker be at "90 cm" when a "25 cm" is thrown. The player uses 10 cm to go to the end, turns around, and moves back 15 cm in the same turn.
2. The Finish Line Case:
   When a player approaches the finish line, he should be (a) allowed to go off the stick and win if the dice give him just enough or more than enough to do so; or, (b) required to toss the dice until they give him just enough to make it to the finish line.

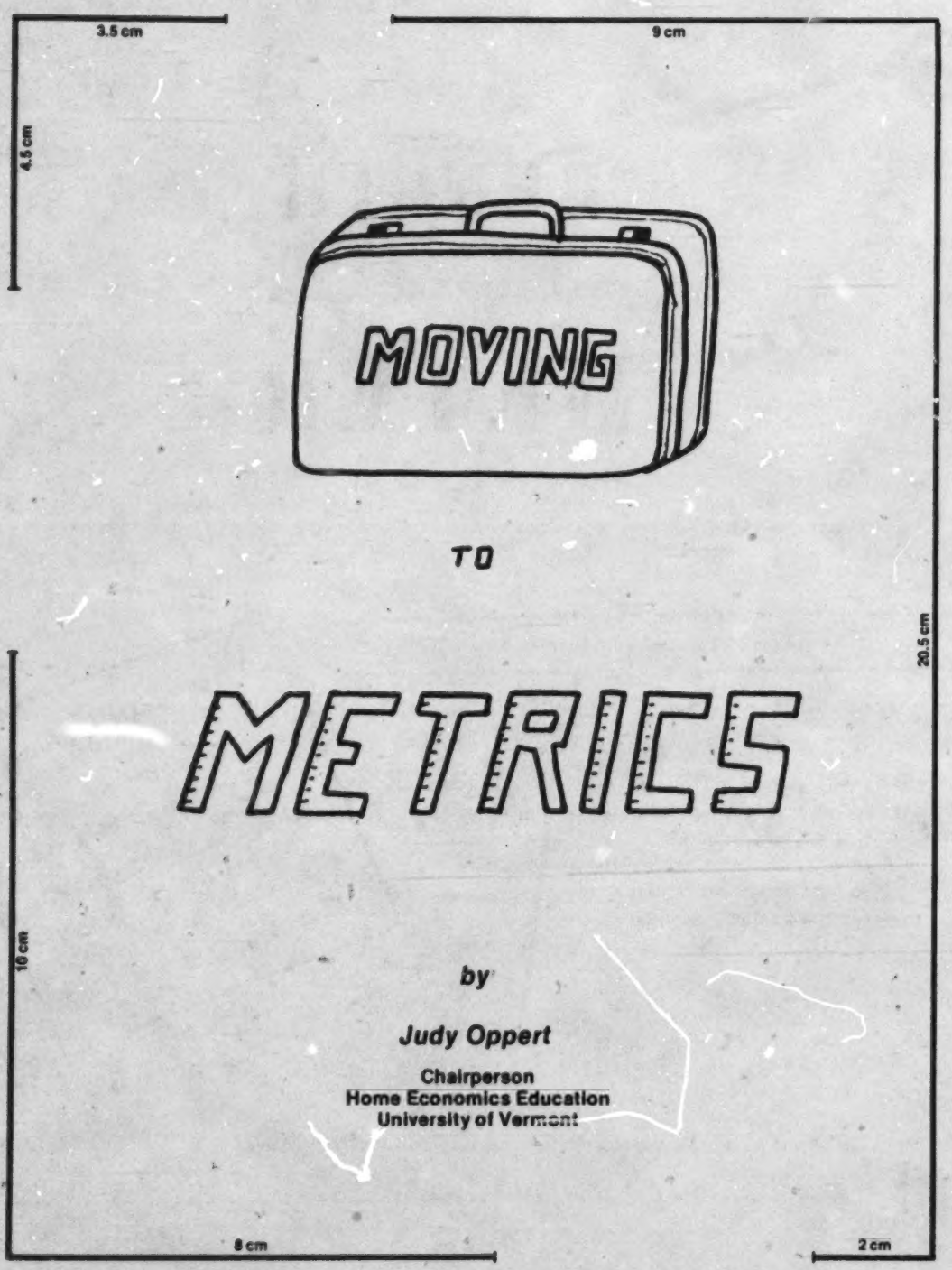
Additional resources relating to games include:

Hallamore, Elisabeth. THE METRIC BOOK OF AMUSING THINGS TO DO. $1.56 school price plus postage.
Barron's Educational Series, Inc.
113 Crossways Park Drive
Woodbury, New York 11797

Ploutz, Paul F. DECIMETER (game), order of approval,
The Lawhead Press, Inc.
900 E. State Street
Athens, OH 45701

Trueblood, Cecil R. METRIC MEASUREMENT—ACTIVITIES AND BULLETIN BOARDS. #319, $2.45,
Instructor Publications, Inc.
Instructor Park
Dansville, NY 14437

Trueblood, Cecil R. and Szabo, Michael. "Procedures for Designing Your Own Metric Games for Pupil Involvement," THE ARITHMETIC TEACHER, May 1974, 21 (5), 404-08.



by

Judy Oppert

Chairperson
Home Economics Education
University of Vermont

HOME ECONOMICS EDUCATION ASSOCIATION
1201 Sixteenth Street, Northwest, Washington, D.C. 20036

The basic unit of

LENGTH

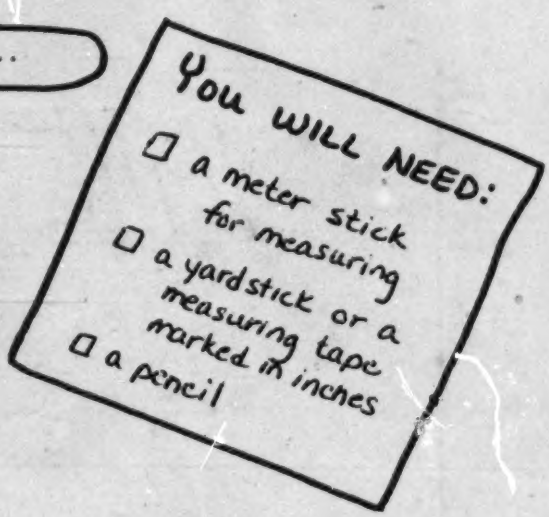
in the metric system is the

METER

Since many of the other metric units are based on the meter, we will learn about the meter first.

As you work through this section, you will . . .

(1) estimate lengths in meters;
(2) use a meter stick to measure length to the nearest meter;
(3) identify the term meter, the amount it refers to, and its symbol; and
(4) compare a meter to a yard.



1. **The meter is the basic unit of length in the metric system. It is pronounced me-ter.**

Look at the meter stick. The meter is used to measure _____.

2. **Look at the door of the room and estimate the height of the door in meters. My estimate of the height of the door is _____ meters.**

3. **Measure the height of the door to the nearest meter. I measured the door to be _____ meters high.**

4. Estimate the length AND width of the room you are in to the nearest meter. Record your estimate.

Length of room _____ meters

Width of room _____ meters

5. Measure the length and width of the room and record your measurements.

Length of room _____ meters

Width of room _____ meters

6. Put one end of the meter stick on the floor and stand beside it. What part of your body is a meter from the floor?

_____

Now you will always know the length of a meter. You will always have the meter measure with you. We call this a REFERENCE POINT. It is a length you can use to help estimate other distances.

7. You can find another meter reference point by measuring between your outstretched arm and your nose.

Place one end of the meter stick on your right hand and the other end on your nose as if you were measuring the length between your outstretched hand and nose. If the distance from the end of your finger tips to your nose is not a meter, turn your nose toward your left shoulder. If you still can't reach the end of the meter stick, measure to your left shoulder instead of your nose.

Check one:

There is one meter between the end of the fingertips of my right hand and

_____ my nose when I look straight ahead

_____ my nose when I turn my head to the left

_____ my left shoulder

8. Find an item you estimate to have a length, width OR height of one meter. Record the name of the item and measure it.

Item _____ Measures _____ meter(s)

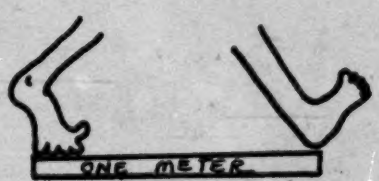
As you practice estimating, your skill will improve. Find four more items, estimate their length, width or height and then measure the items.

Item	Estimate	Measurement
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

9. Instead of writing the word "meter" we can use its symbol. The symbol is the letter **m** and it is always written in lower case (not capitalized) without any punctuation.

Write the symbol for meter in the blank. _____

10. Lay the meter stick on the floor and try to take a step that is a meter long.



Many people take long steps or strides to measure the length of an area. Their strides are about one yard long. Do you think a meter is longer or shorter than a yard? _____

11. Use an inch measuring tape or yard stick and compare a yard (36 inches) to your meter measure. Which is longer, a yard or a meter? _____

12. Check one:

To make a pair of pants I would purchase

_____ 0.5 meter of fabric

_____ 2 meters of fabric

_____ 5 meters of fabric

_____ 10 meters of fabric

TURN THE PAGE UPSIDE DOWN TO FIND THE ANSWERS.

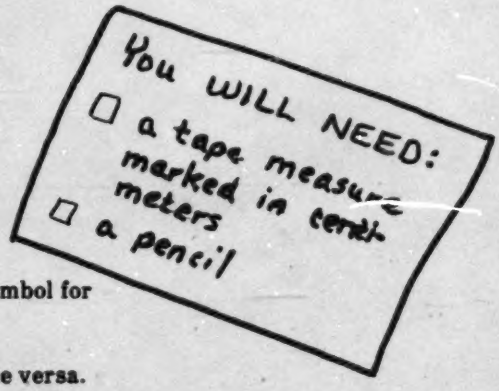
METER ANSWERS

1. length (height, width or distance)
2. 2 meters
3. 2 meters
4. _____ meters, _____ meters
5. _____ meters, _____ meters
6. waist, hip bone, belly button (depending on your height)
7. depends on you
8. answers based on your surroundings
9. m
10. longer
11. meter
12. 2 meters

It is time to meet the

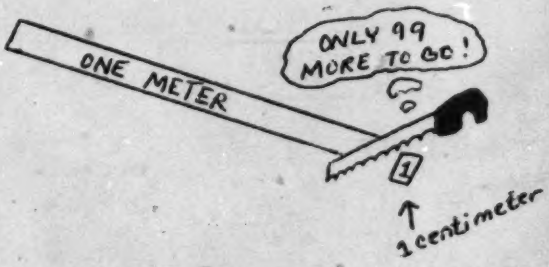
CENTIMETER

As you work through this section, you will . . .



(1) identify the number of centimeters in one meter,
(2) recognize the distance equal to a centimeter and the symbol for centimeter,
(3) estimate and measure distances in centimeters, and
(4) change measures given in centimeters to meters and vice versa.

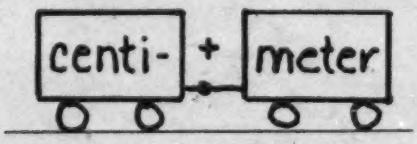
1. Look at the centimeter tape measure. A meter can be divided into *smaller* sections called centimeters. Can you find a centimeter marking on the tape measure? It is about the distance across your little finger.



How many centimeters are in a meter? _____

One meter equals _____ centimeters.

2. We have added a prefix to the word meter to indicate this small unit. The prefix is centi.



To help you remember, think of our money system.

Does the prefix centi remind you of cent?_____

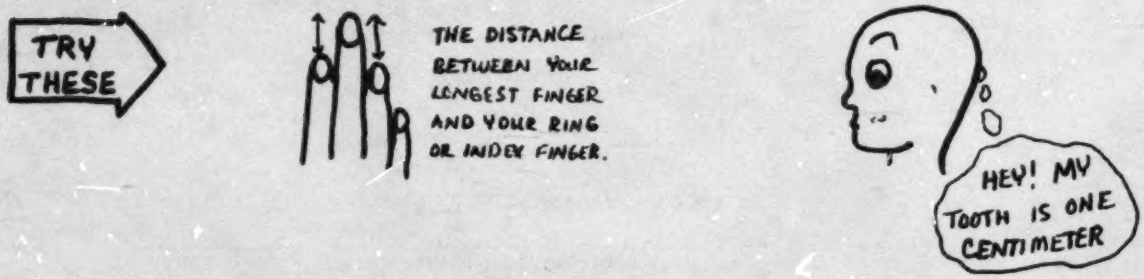
How many cents are in a dollar? _____

How many centimeters are in a meter?_____

The prefix centi indicates that a meter is DIVIDED into 100 parts.

100 CENTIMETERS = 1 METER

3. To use centimeters you need to have an idea of how long a centimeter is. Measure the distance across your little finger at the base of the fingernail. Is it a centimeter? ____ If this distance is not one centimeter, what other reference point can you find?



4. Look at the palm of your hand and estimate the distance across it in centimeters.

_____ centimeters

5. Measure the distance across your palm in centimeters.

_____ centimeters

6. To become more familiar with centimeters, choose five items and estimate their length, width or height in centimeters. Then measure the items with your metric tape measure.

Item	Estimate	Measurement
_____	_____ cm	_____ cm
_____	_____ cm	_____ cm
_____	_____ cm	_____ cm
_____	_____ cm	_____ cm
_____	_____ cm	_____ cm

7. Did you notice the symbol for centimeter in the former question? It is the letters cm and again it is written in small letters without a period. Write the symbol for centimeter in the blank. _____

8. It can be difficult to change from inches to yards, but it is easier to change from one unit to another in the metric system. We could write 50 centimeters or 0.5 m to indicate half of a meter. It is similar to writing 50¢ or $.50 to indicate the same part of a dollar. Fill in the following blanks by changing centimeters to meters or vice versa.

75 centimeters = _____ meter

33 centimeters = _____ meter

1 centimeter = _____ meter

150 centimeters = _____ meter(s)

_____ centimeters = 2 meters

_____ centimeters = 67 meters

_____ centimeters = 0.35 meter

_____ centimeters = 0.10 meter

_____ centimeters = 0.01 meter

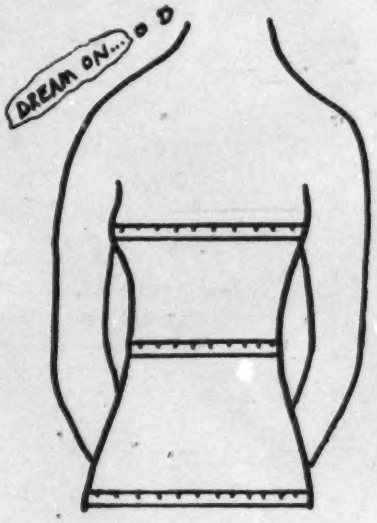
9. My measurements are:

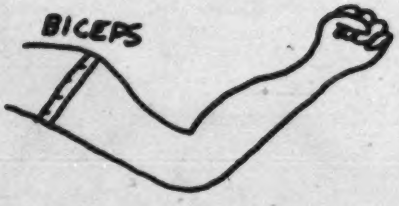
chest or bust = _____ cm

waist = _____ cm

hips = _____ cm

height = _____ cm





Other measurements I am interested in knowing:

_____ = _____ cm

_____ = _____ cm

10. Check one:

The height of the countertop from the floor is about

_____ 40 cm

_____ 90 cm

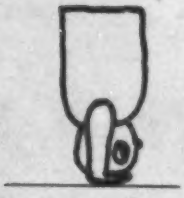
_____ 125 cm

_____ 150 cm

☆ ☆

CENTIMETER ANSWERS

1. 100, 100
2. it depends, 100, 100
3. depends on you
4. & 5. depends on you
6. answers based on your surroundings
7. cm
8. 0.75
0.33
0.01
1.50
200
6700
35
10
1
9. depends on you
10. 90 cm



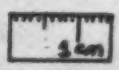
To measure very small distances we use the

MILLIMETER

As you work through this section, you will . . .

YOU WILL NEED:
- ☐ a tape measure or meter stick marked in millimeters
- ☐ a pencil
- ☐ a paperclip

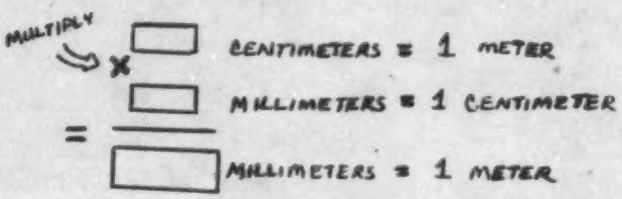
(1) identify the number of millimeters in one meter;
(2) recognize the term millimeter, the amount it refers to, and its symbol;
(3) estimate and measure in millimeters; and
(4) change measures given in millimeters to centimeters and vice versa.

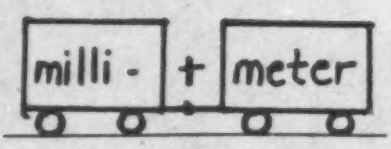
1. 

Find a centimeter mark on the measuring tool. Have you noticed the small marks between each centimeter mark? The centimeter is divided into small units called millimeters.

How many millimeters are in one centimeter? _____

2. Do you remember how many centimeters there are in a meter? We can calculate the number of milliliters in a meter.





Milli is a prefix which is added to meter just like the prefix centi. It may help you to think of the mill used in computing taxes when you see the prefix milli. For tax purposes a mill is equal to one thousandth of a dollar or one tenth of a cent. The prefix milli indicates that a unit is DIVIDED into 1000 parts.

1000 MILLIMETERS = 1 METER

3. A millimeter is a very small length. You may find a reference point on your body such as the thickness of a fingernail. Also, measure the distance across the head of a pin OR the distance across a wire in a paperclip.

These items are _____ millimeter(s) across.

4. The symbol for millimeter is **mm** and it is written in small letters without punctuation.

Write the symbol for millimeter in the following blank. _____

5. Look at a paperclip and estimate the distance across it in millimeters. _____ mm

6. Measure the distance across the paperclip in millimeters. _____ mm

7. As you estimate and measure lengths in millimeters you will become more familiar with this metric unit. Find five items and estimate their length, width or height in millimeters. Then measure the items and record the measurements.

Item	Estimate	Measurement
_____	_____ mm	_____ mm
_____	_____ mm	_____ mm
_____	_____ mm	_____ mm
_____	_____ mm	_____ mm
_____	_____ mm	_____ mm

8. Millimeters can be changed to centimeters, meters and other units of length. For example, 10 millimeters can be changed to 1 centimeter. We have divided by 10, and this moved the decimal point one place to the left. Fill in the following blanks by converting millimeters to centimeters or vice versa.

5 millimeters = _____ centimeter(s)

50 millimeters = _____ centimeter(s)

500 millimeters = _____ centimeter(s)

2000 millimeters = _____ centimeter(s)

147 millimeters = _____ centimeter(s)

_____ millimeters = 10 centimeters

_____ millimeters = 5 centimeters

_____ millimeters = 0.15 centimeter

_____ millimeters = 1.5 centimeters

9. **Check one:**

When we sew, the usual seam allowance is

_____ 1 mm

_____ 5 mm

_____ 10 mm

_____ 15 mm

10. **Paper sizes may be stated in millimeters. What is the length and width of this page in millimeters?**

_____ 50 mm by 100 mm

_____ 100 mm by 200 mm

_____ 200 mm by 300 mm

_____ 300 mm by 400 mm

TURN THE PAGE UPSIDE DOWN TO FIND OUT HOW YOU ARE DOING

MILLIMETER ANSWERS

1. 10
2. 100 × 10 = 1000
3. 1
4. mm
5. depends on you
6. about 7–9 mm for paperclip of average size
7. depends on your surroundings
8. 0.5
9. 15 mm
10. 200 by 300 mm

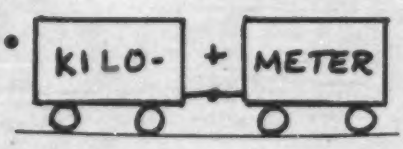
To measure long distances we use the

KILOMETER

As you work through this section, you will . . .

(1) identify the number of meters in one kilometer;
(2) recognize the term kilometer, the amount it refers to, and its symbol;
(3) read a map with a kilometer scale; and
(4) change kilometers to meters and vice versa.

1. When we travel long distances we need a large unit of measure. This unit is called the kilometer and it is pronounced KILL-oh-me-ter. Can you pronounce it correctly?

2. 

We add the prefix kilo to meter to measure long distances. The prefix kilo indicates to MULTIPLY by 1000. How many meters are in a kilometer?

_____

3. The prefix kilo is different from the prefix milli.
Kilo indicates to MULTIPLY by 1000.
Milli indicates to DIVIDE by 1000.

Number the following units in order from largest (1) to smallest (3).

_____ kilometer

_____ millimeter

_____ meter

4. A kilometer is a little longer than one-half mile. It is about 0.6 mile. When you travel 100 kilometers, it is about 60 meters. Ten kilometers is about 6 miles.

Check one:

When we measure 5 miles in metric units, it will be about

_____ 2 kilometers

_____ 5 kilometers

_____ 8 kilometers

_____ 10 kilometers

5. There is a symbol for kilometer and it is the letters **km**. The symbol is not capitalized and it is used without punctuation.

Write the symbol for kilometer in the blank. _____

6. Using a map with a kilometer scale, measure the distance between different locations in kilometers. Record your readings on the following chart.

From	To	Distance
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

7. Kilometers can be converted to meters and vice versa. To change kilometers to meters multiply by 1000, and to convert meters to kilometers divide by 1000. Convert the following units and fill in the blanks.

5 kilometers = _____ meters

300 kilometers = _____ meters

0.1 kilometers = _____ meters

36 kilometers = _____ meters

_____ kilometer = 10 meters

_____ kilometer = 300 meters

_____ kilometers = 7 000 meters

_____ kilometers = 15 000 meters

8. **Check one:**

Now we have a speed limit of 55 miles per hour. In metric units this will be about

_____ **22 kilometers per hour**

_____ **55 kilometers per hour**

_____ **88 kilometers per hour**

_____ **110 kilometers per hour**

TURN THE PAGE UPSIDE DOWN TO FIND OUT HOW YOU ARE DOING

KILOMETER ANSWERS

1. depends
2. 1000
3. 1-kilometer
   2-meter
   3-millimeter
4. 8 kilometers
5. km
6. depends on you
7. 5000
   300 000
   100
   36 000
   0.01
   0.3
   7
   15
8. 88 kilometers per hour

To find the size of an

AREA

we use the units of length such as the meter and centimeter.

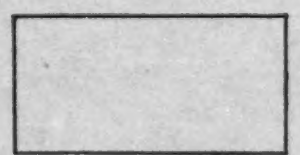
As you work through this section, you will . . .

(1) compute the area of rectangles and squares;
(2) measure the length and width of articles and compute the area of these items;
(3) recognize the symbols used for metric areas; and
(4) identify the term hectare, the amount it refers to, and its symbol.

YOU WILL NEED:

- ☐ a ruler or tape measure marked in centimeters
- ☐ a pencil
- ☐ a stamp, an envelope, and a dollar bill

1. To find the area of a rectangle, we measure the length and width of the rectangle and multiply.



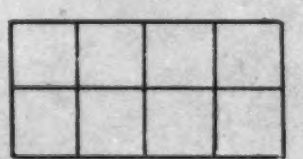
Area = Length × Width

What is the area of this rectangle?

Length = _____ centimeters
×
Width = _____ centimeters

Area = _____ square centimeters

2. Did you notice that the answer was in square centimeters? Area is measured in square units. For instance, we could think of the rectangle we measured as being divided into centimeter squares.



How many square centimeters are in the rectangle? _____

3. We have learned that one centimeter contains _____ millimeters. To find the area of a square centimeter, we remember that the four sides of a square each have the same length measurement. Therefore, we multiply the same number times itself to determine the area.

$10 \times 10 =$ _____ square millimeters in a square centimeter

4. Let's practice finding the area of some rectangles and squares. What is the area of each of the following?

A rectangle 3 centimeters long and 5 centimeters wide? _____ square centimeters

A square with sides that each measure 2 centimeters? _____ square centimeters

A rectangle 15 millimeters long and 25 millimeters wide? _____ square millimeters

A square with sides that are each 100 millimeters long? _____ square millimeters

A rectangle 150 meters long and 200 meters wide? _____ square meters

A square with sides that each measure 25 meters? _____ square meters

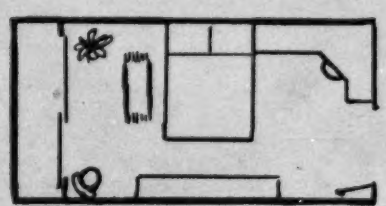
5. When you were studying the meter you estimated and measured the length and width of the room you were in. Use those measurements and calculate the area of the room.

Length of room = _____ meters

×

Width of room = _____ meters

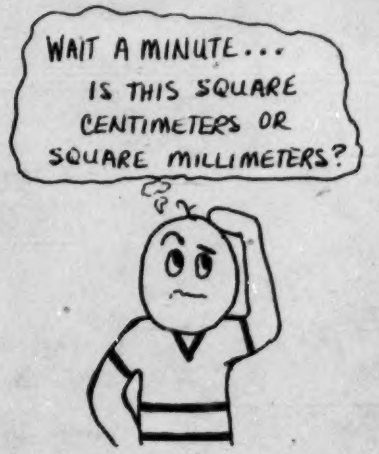
Area = _____ square meters



6. Using a tape measure or ruler marked in centimeters, measure the following items and calculate their area.

Item	Length	Width	Area	
Postage stamp	_____	_____	_____	_____ square centimeters
Dollar bill	_____	_____	_____	_____ square centimeters
Envelope	_____	_____	_____	_____ square centimeters
This page	_____	_____	_____	_____ square centimeters
_____ (your choice)	_____	_____	_____	_____ square centimeters

7. What is the area of a rectangle that measures 12 millimeters long and 10 centimeters wide? _____



Is your answer 120 square millimeters or centimeters? If it is, did you notice that the length of the rectangle was in millimeter units and the width was in centimeter units? To calculate an area problem, the units of both dimensions must be the same. You have already changed millimeter measurements to centimeters and vice versa when you learned about millimeters. When we change the numbers and compute the problem, we find that the correct answer is 12 square centimeters or 1200 square millimeters. Can you change the numbers and compute the correct answer? (Yes or No)

_____

$1\text{cm} = 10\text{mm}$

$12\text{mm} = 1.2\text{ cm}$
$\times\ 10\text{ cm}$
12 cm^2

length $\times$ width
area

$10\text{ cm} \times 12\text{ mm}$
100 mm
1200 mm^2

8. **The units of length had symbols, and the area units have symbols, too. The symbol for square meter is m^2 and it does not have punctuation. Write the symbol for each of the following:**

square millimeters _____

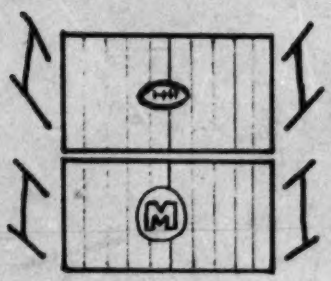
square centimeters _____

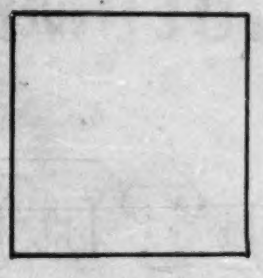
square meters _____

square kilometers _____

Note that the raised number 2 always *follows* the symbol and we always say "square" *before* the name of the unit.

9. The area of two football fields, side-by-side, would be about 100 square meters. This area has a special name, and it is called a hectare.





That's pronounced: heck-tair

It is prounounced heck-tair. Can you pronounce hectare correctly? _____

10. Hectares will be used in land measurement like we use acres. A hectare is about 2.5 acres, and a five-acre field is approximately 2 hectares. About how many hectares would a 20-acre plot contain? _____

11. Hectare is only used to measure area. It is not a length measurement. Therefore, we do not need to use the word "square" with hectare. The symbol for hectare is **ha** without a period. Write the symbol for hectare in the blank. _____

12. Check one:

When purchasing carpeting for a living room, the appropriate calculations would be

_____ 6 meters long × 4 kilometers = 24 square meters

_____ 5 meters long × 6 meters wide = 30 meters square

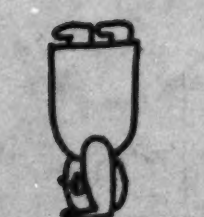
_____ 6 meters long × 1 meter wide = 24 m^2

_____ 5 meters long × 6 meters wide = 30 square meters

TURN THE PAGE UPSIDE DOWN TO FIND THE CORRECT ANSWERS

AREA ANSWERS

1. 2 cm × 4 cm = 8 cm^2
2. 8
3. 10, 100
4. 15 cm^2
   4 cm^2
   375 mm^2
   10 000 mm^2
   30 000 m^2
   625 m^2
5. & 6. answers based on your surroundings
7. 12 cm^2 or 1200 mm^2, yes
8. mm^2
   cm^2
   m^2
   km^2
9. depends on you
10. 8
11. ha
12. 5 m × 6 m = 30 square meters



The basic unit of

VOLUME

in the metric system is the

LITER

You will need:
- ☐ a liter or half-liter measure
- ☐ a half-gallon milk carton
- ☐ a quart milk carton or measure
- ☐ a centimeter measure
- ☐ water
- ☐ a pencil

As you work through this section, you will . . .

(1) identify the term liter, the amount it refers to, and its symbol;
(2) use a liter measure to determine volume;
(3) compare a liter to a quart; and
(4) calculate volume and discover the relationship between metric units of volume and length.

1. The liter is the basic unit of volume in the metric system. It is pronounced lee-ter. Look at the volume measure. The unit used to measure volume in the metric system is the

_____.

2. Fill the volume measure and pour one liter of water into an empty half-gallon milk carton. (If you have a 500 milliliter measure, you will need to fill it twice to measure one liter.) Approximately what percent of the milk carton is filled with water? _____

3. Pour the liter of water into the quart milk carton or quart measure. How does the liter compare with the quart?

Check one:

The liter is

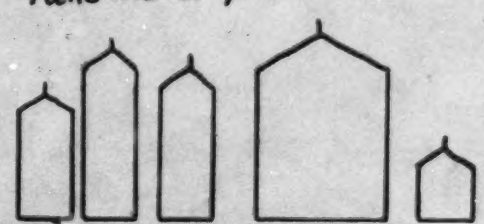
_____ less than a quart

_____ equal to a quart

_____ greater than a quart

_____ equal to a half-gallon

Take me to your liter.



4. We do not want to confuse the symbol for liter with the number one (1). Therefore, we use a capital L for the liter symbol. Write the symbol for liter in the blank. _____

5. We can measure and calculate the volume of a container just as we calculated the area of an item. We multiply the length times the width as we did for area, and then we multiply the result by the height. As with area, all of the measurement units must be the same. To indicate volume, we "cube" the units and write cubic or add a raised three behind the symbol (example: cubic centimeters or cm^3).

If we have a cube that measured 5 centimeters long, 10 centimeters wide and 20 centimeters high, what would its volume be?

5 cm × 10 cm × 20 cm = _____

6. Let's calculate the volume of another container. This one has a length, width and height that each measure 10 centimeters.

10 cm × 10 cm × 10 cm = _____

7. Measure the length and width of the bottom of the half-gallon milk container. Measure the height of the liter of water when it is in the container. Calculate the volume.

_____ cm × _____ cm × _____ cm = _____

8. Did you get the same answer for each of the last three problems? In each of these problems, we were calculating the volume of a container that would hold a liter. Therefore,

we can say that 1000 cm^3 = 1 _____.

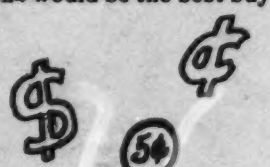
The metric system was designed to relate the units of length and volume, but our customary measuring system does not have this feature.

9. Some of our beverages are now being sold in liter containers. Check one:

If both containers are the same price, which one would be the best buy?

_____ liter

_____ quart



10. In the future gasoline will be sold by the liter. It is now sold by the gallon in the United States. Check one:

How will the number of liters compare with the number of gallons in the gas tank?

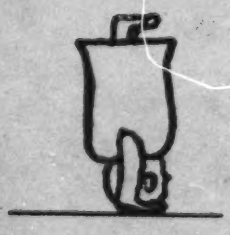
_____ The number of liters will be less than the number of gallons.

_____ The number of liters and gallons will be about the same.

_____ The number of liters will be greater than the number of gallons.

TURN THE PAGE UPSIDE DOWN TO FIND OUT HOW YOU ARE DOING

LITER ANSWERS



1. liter
2. 50%
3. greater than a quart
4. L
5. 1000 cm³
6. 1000 cm³
7. depends on carton
8. liter
9. liter
10. number of liters will be greater

To measure smaller volumes, we use the

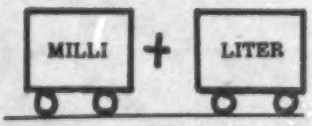
MILLILITER

As you work through this section, you will . . .

(1) identify the number of milliliters in one liter,
(2) measure the volume of some familiar containers,
(3) recognize the volume equal to a milliliter and the symbol for milliliter, and
(4) change measures given in milliliters to liters and vice versa.

YOU WILL NEED:
- ☐ small metric measures (1, 2, 5, 15, 25 mL)
- ☐ 250 mL liquid measure
- ☐ teaspoon measure
- ☐ water
- ☐ containers such as a glass, cup, or bowl

1. To measure small volumes of materials, we will use units called milliliters. We learned earlier that milli is a prefix which indicates a unit is DIVIDED into a number of parts.



How many milliliters are in a liter? _____

2. Like the liter, this volume measure is related to quantities of length and area. A liter is equal to 1000 cubic centimeters,

$$1\ L = 1000\ cm^3$$

and a milliliter is equivalent to a _____.

Cubic Centimeter (cm^3)
or
Milliliter

3. A centimeter cube (like the illustration) will hold one milliliter of cool water. The one milliliter metric measure (shaped like a spoon) will measure the same amount.

Can you measure one milliliter of water? _____

4. Using the one milliliter metric measure, count the number of milliliters it takes to fill a teaspoon. (Use the teaspoon we now use to measure recipe ingredients.)

One teaspoon = _____ milliliters

5. The symbol for milliliter is **mL** and it is written without punctuation. Write the symbol for milliliter in the following blank. _____

6. Estimate the volume of five containers. You might choose a cup, glass, cereal bowl, bottle and so on. Then using the metric volume measures, measure a volume of water and pour it into the containers to determine their volume.

Item	Estimate	Measurement
_____	_____ mL	_____ mL
_____	_____ mL	_____ mL
_____	_____ mL	_____ mL
_____	_____ mL	_____ mL
_____	_____ mL	_____ mL

7. Milliliters can be changed to liters and vice versa. When milliliters are changed to liters, we divide by 1000 and the decimal point moves three places to the left. For example, 100 milliliters can be changed to 0.1 liter.

When liters are changed to milliliters, we multiply by 1000 and the decimal moves to the right. Fill in the following blanks.

700 milliliters = _____ liter(s)

4 milliliters = _____ liter(s)

5624 milliliters = _____ liter(s)

_____ milliliters = 0.4 liter

_____ milliliters = 6 liters

_____ milliliters = 10 liters

_____ milliliters = 5.23 liters

8. **Check one:**

When we measure ingredients for recipes, we will probably use

_____ **millimeters**

_____ **milliliters**

_____ **meters**

_____ **hectares**

9. **Check one:**

Instead of "1 cup," a recipe will probably read

_____ **250 mL**

_____ **20 mL**

_____ **2 L**

_____ **200 mm**

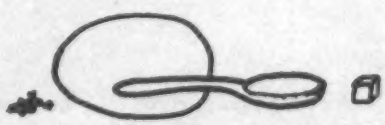
10. **A milliliter is about the size of**

_____ **a teaspoon**

_____ **an egg**

_____ **a grain of salt**

_____ **a sugar cube**



TURN THE PAGE UPSIDE DOWN TO FIND OUT HOW YOU ARE DOING

MILLILITER ANSWERS

1. 1000
2. cubic centimeter or cm³
3. yes
4. 5
5. mL
6. depends on your surroundings
7. 0.7
8. milliliters
9. 250 mL
10. a sugar cube

The basic unit of

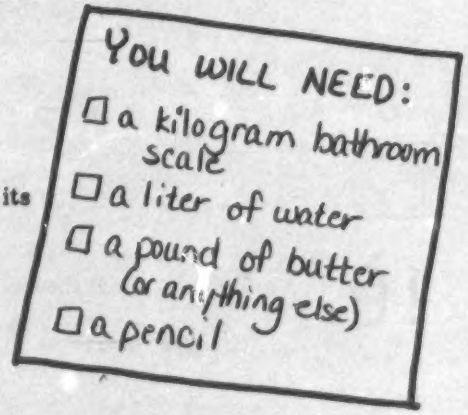
WEIGHT

is the

KILOGRAM

As you work through this section, you will . . .

(1) identify the term kilogram, the amount it refers to, and its symbol;
(2) estimate weight in kilograms;
(3) use a kilogram scale to measure weight;
(4) compare a kilogram to a pound; and
(5) identify the term metric ton and its symbol.



1. As we go metric you may hear some people use the word "mass" instead of weight. Both words, mass and weight, are used to describe the amount of matter in an object.

The base unit of weight or mass in the metric system is the kilogram. Look at the kilogram scale. The unit used to measure weight in the metric system is the _____.

2. Determine the weight of a liter of water. (You may need to weigh the container before the water is added and later subtract this weight *or* place the container on the scale and adjust the dial to zero before adding the water.)

What is the weight of a liter of water? _____

3. Now you have a reference point for a kilogram. Lift the liter of water to feel how heavy it is. One liter of water has a weight (or mass) of one kilogram.

Let's find another kilogram reference point. Measure your weight in kilograms and write it in the blank. _____

Memorize your weight in kilograms and use it as a reference point when another weight is given in kilograms. Compare the new weight with your weight. Is it heavier or lighter than you? How big is the difference?

4. Check one:

Two suitcases being loaded on an airplane have a weight of 20 kilograms. Twenty kilograms is about

_____ 20 pounds

_____ 40 pounds

_____ 100 pounds

_____ 130 pounds

5. The kilogram unit is symbolized by the letters kg. This symbol is not capitalized, and it does not have a period except when it appears at the end of a sentence. Write the symbol for kilogram in the blank. _____

6. Choose five items, estimate their weight in kilograms, and measure their weight. Hint: use your reference points when estimating the weights. Suggestions of items include a bag of potatoes, bag of sugar, large purse, stack of books, chair and so on.

Item	Estimate	Measurement
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

7. Compare the weight of the kilogram of water with a pound of butter, coffee or other food. Which is heavier? _____

If you are very good at comparing weights, you will find that the kilogram is more than twice as heavy as a pound. A kilogram is equal to a little more than two pounds.

8. When we buy meat, poultry, butter, coffee and sugar in the future, they will probably be sold in kilogram units. Check one:

Compared to a pound, a kilogram will be about

_____ half as much

_____ the same

_____ twice as much

_____ three times as much

9. Sometimes we may need to use a larger unit of weight and it is called a metric ton. News reports about foreign grain deals often contain the metric ton unit. The metric ton is equivalent to 1000 kilograms. Did you notice that this unit contains the word "metric"?

_____ The word "metric" is used to distinguish this unit from our customary ton.

10. The symbol for the metric ton is t and it is written without capitalization or punctuation. What is the symbol for metric ton? _____

o o o o o o o o o o o o o o

TURN THE PAGE UPSIDE DOWN TO FIND THE ANSWERS

KILOGRAM ANSWERS

1. kilogram
2. 1 kilogram
3. depends on you
4. 40 pounds
5. kg
6. depends on your surroundings
7. kilogram
8. twice as much
9. yes
10. t

It is time to meet the

GRAM

As you work through this section, you will . . .

(1) identify the number of grams in one kilogram,
(2) recognize the weight equal to a gram and the symbol for gram,
(3) estimate and measure weight in grams, and
(4) change measures given in grams to kilograms and vice versa.

YOU WILL NEED:
- ☐ a metric scale ranging from 1 gram to 1 kilogram
- ☐ one mL of water
- ☐ items to weigh (nickel, paperclip)
- ☐ labels marked in gram weight
- ☐ a pencil

1. Did you notice the prefix kilo when you were learning about kilograms? A kilogram is equal to 1000 grams. How many grams are equivalent to a kilogram? _____

2. How many milliliters are equal to a liter? _____

A liter of water has a weight of one kilogram. A kilogram is equal to 1000 grams. Can you figure out the weight of a milliliter of water?

A milliliter of water has a weight of _____.

3. Check your answer by weighing one milliliter of water on the gram scale. Don't forget to subtract, or allow for, the weight of the water container.

I found that one milliliter of water weighs _____.

I'm going to weigh this paper clip.
I'll try this nickel
I've got some M&M's and raisins I'll weigh before they disappear
I'll weigh this thumbtack instead of sitting on it!!

4. Can you find another item that has a weight of one gram? Items that have a weight of one gram include:

5. The symbol for gram is g and it is not capitalized or punctuated. Write the symbol for gram in the blank. _____

6. Let's try estimating the weight of some items and then weigh them in grams to check the accuracy of the estimate.

Item	Estimate	Measure
Nickel	_____	_____
Pencil	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

7. If the weight of a package of hamburger is given in grams and you have a recipe that gives the amount of hamburger in kilograms, you will need to change grams to kilograms.

To change grams to kilograms, divide by 1000 or move the decimal point three places to the left.

Example: 300 grams is equal to 0.3 kilograms

To change kilograms to grams, multiply by 1000 or move the decimal point three places to the right. Fill in the following blanks by changing grams to kilograms or vice versa.

427 grams = _____ kilogram	_____ grams = 0.45 kilogram
500.5 grams = _____ kilogram	_____ grams = 58 kilograms
16 823 grams = _____ kilograms	_____ grams = 1.2 kilograms
5 grams = _____ kilogram	_____ grams = 5 kilograms

8. Grams will be used instead of ounces, and sometimes, pounds. Can you think of some things that will be measured in grams as we go metric? List three items that will probably be measured in grams.

(1) _____

(2) _____

(3) _____

9. **Many of the nutrition labels contain the gram symbol. Can you find some labels that contain the symbol for grams? Are all of the gram symbols written correctly?**

Labels that have the correct gram symbol include:

Labels that have the incorrect gram symbol include:

Check one:

10. **A teaspoon will hold five milliliters of water and the water will weigh**

_____ **0.5 gram**

_____ **5 grams**

_____ **50 grams**

_____ **500 grams**

▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲

TURN THE PAGE UPSIDE DOWN TO FIND OUT HOW YOU ARE DOING

GRAM ANSWERS

1. 1000
2. 1000, 1 gram
3. 1 gram
4. depends—paper clip, raisin, M & M
5. g
6. depends on your surroundings
7. 0.427
8. garden seeds
   spices
   some cheeses
   candles
   etc.
9. depends on your surroundings
10. 5 grams

0.500 5
16.828
0.005
450
58 000
1 200
5 000

To measure very small amounts of weight we use the

MILLIGRAM

As you work through this section, you will . . .

- (1) identify the number of milligrams in one gram;
- (2) recognize the term milligram, the amount it refers to, and its symbol;
- (3) observe where the milligram unit is used; and
- (4) change measures given in milligrams to grams and vice versa.

You will need:
- ☐ labels marked in milligrams (nutrition labels & pharmacy items)
- ☐ a pencil

1. When we studied the millimeter and milliliter we learned that milli is a prefix. In review, a mill is equal to one thousandth of a dollar for tax purposes, and the prefix milli indicates that a unit is DIVIDED into 1000 parts.

How many milligrams are in a gram? _____

2. A milligram is a very small weight. It is approximately the weight of a grain of salt. We can use the grain of salt as a reference point when we think of milligrams.

A grain of salt has a weight of approximately _____.

3. One reference point for a milligram is _____.

4. The symbol for milligram is mg and it is written in small letters without punctuation.

Write the symbol for milligram in the following blank. _____

5. The milligram is useful for working with small amounts of nutrients. It is also used in pharmacy to measure drugs. Most of us will not measure items in milligrams, but there are times when we will want to know the weight of a certain number of milligrams. Look around and try to find things that are measured in milligrams. (Check nutrition labels and pharmacy items.)

Who'd have thought I'd learn metrics from my cereal box.

I found the following items measured in milligrams:

6. Milligrams can be changed to grams and other units of weight or mass. For example, 100 milligrams is equal to 0.1 gram.

To change milligrams to grams, divide by 1000 or move the decimal point three places to the left.

To change grams to milligrams, multiply by 1000 or move the decimal point three places to the right.

Example: 3 grams is equal to 3000 milligrams

Fill in the following blanks by changing milligrams to grams or vice versa.

2.56 milligrams = _____ gram

578 milligrams = _____ gram

16 945 milligrams = _____ grams

523 700 milligrams = _____ grams

_____ milligrams = 1.5 grams

_____ milligrams = 4 grams

_____ milligrams = 52.346 grams

7. Check one:

Milligrams would be the appropriate unit to describe the weight of a

_____ can of soup

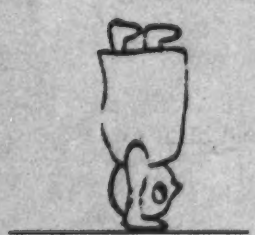
_____ package of cheese

_____ vitamin in a food

_____ serving of meat

• • • • • • • • • • • • • •

TURN THE PAGE UPSIDE DOWN TO CHECK YOUR ANSWERS



1. 1000
2. 1 milligram
3. a grain of salt
4. mg
5. depends on your surroundings
6. 0.002 56
   0.578
   16.945
   528.700
   1 500
   4 000
   52 346
7. vitamin in a food

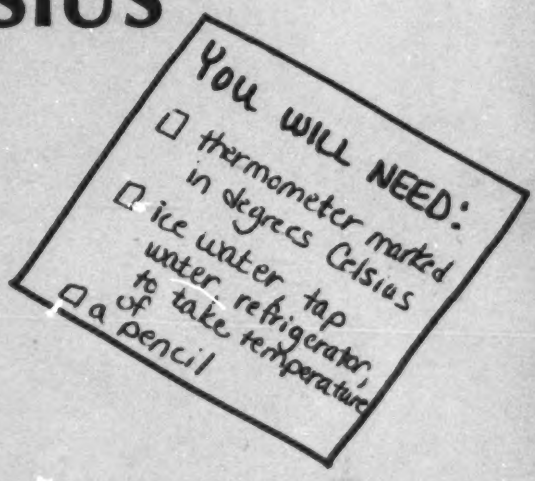
51

To measure

TEMPERATURE

we use the

DEGREE CELSIUS



As you work through this section, you will

(1) recognize the term degree Celsius and its symbol,
(2) identify some reference points on a Celsius thermometer,
(3) estimate temperature in degrees Celsius, and
(4) measure temperature with a Celsius thermometer.

1. The degree Celsius is the unit most of us will use to measure temperature. Celsius is pronounced sell-see-us. Look at the thermometer and the degree markings.

Temperature will be measured in _____.

2. We can use the symbol for degree Celsius when we record estimates and measurements of temperature. The symbol for degree Celsius is °C and it is written without punctuation. Unlike many of the other symbols, this symbol is capitalized. Celsius is the name of the man who is given credit for developing this measurement scale for temperature.

Write the symbol for degree Celsius in the blank. _____

3. To become familiar with the Celsius thermometer we will learn some reference points. We will find some convenient points on the Celsius scale and try to associate them with things that happen or feelings we have at those temperatures.

Look at the Celsius thermometer and find 0 °C. This is the temperature at which ice melts. Can you find 0 °C on the thermometer? _____

4. Room temperature is about 20 °C. When the temperature outdoors is around 20 °C we can walk outside and be comfortable. Look at your thermometer.

What is the temperature in your room? _____

5. Our normal body temperature is 37 °C. Place the Celsius thermometer under your bare arm for a few minutes. (Normal underarm temperature is 36 °C, which is one Celsius degree lower than body temperature.)

What is your underarm temperature? _____

6. Water boils at 100 °C. Does your thermometer measure up to the boiling point? _____

7. We use higher temperatures for food preparation. In the future, oven dials may be marked in numbers between 100 and 250 degrees Celsius. We will need to read the directions carefully to see what temperature units are given in a recipe.

Check one:

In the future a cake recipe might direct us to bake the cake at

_____ 375 °F

_____ 375 °C

_____ 190 °F

_____ 190 °C

8. Find five items, estimate and then measure the temperature of the items. Suggestions include ice, water, outdoor temperature, refrigerator shelf temperature, a sunny window sill and so on.

Item	Estimate	Measurement
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Check one:

9. When the temperature is 10 °C outdoors, it would be appropriate to wear

_____ insulated clothing

_____ a light coat

_____ "street clothes" without a sweater

_____ a swimming suit

10. **Check one:**

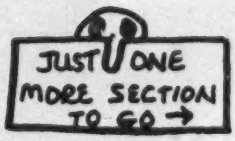
When the temperature is 30 °C outdoors, it would be appropriate to wear

_____ **insulated clothing** I'll shiver ?

_____ **a light coat** OR 30°C ?

_____ **"street clothes" without a sweater**

_____ **a swimming suit** ? 30°C sweat



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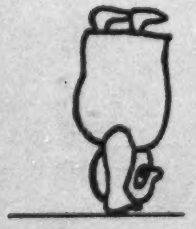
TURN THE PAGE UPSIDE DOWN TO SEE THE ANSWERS



DEGREE CELSIUS ANSWERS

1. degrees Celsius
2. °C
3. yes
4. depends on your surroundings
5. depends on you
6. depends on your thermometer
7. 190 °C
8. answers based on your surroundings
9. a light coat
10. a swimming suit

OTHER UNITS

The metric units you have learned in these sections are the ones you will probably be using everyday. There are more units in the metric system, and you can learn them when you have a need to use them. We will identify a few of the other metric units in this section so you will be able to recognize them in the future as metric units.

1. **Have you wondered about the units we will use to measure time in the future? The *second* will continue to be used, and it is the base unit of time. Its symbol is s; and the minute, hour, and day will also continue to be used.**

The base unit for time is the _____.

2. **Energy will be measured in *joules* (rhymes with pools) instead of calories as we go metric. When we talk about the Calories in our food, we are really referring to kilocalories. One kilocalorie is approximately equal to four kilojoules. The symbol for joule is J and the symbol for kilojoule is kJ.**

The unit for measuring energy is the _____.

3. **The *watt* and kilowatt have been used as units of power and they will continue to be used. Engines and motors will be rated in kilowatts. The symbol for kilowatt is kW and a capital W is the symbol for watt.**

Watts and kilowatts will be used to measure _____.

4. **We will measure pressure in *kilopascal* units. Weather reports often give the barometric air pressure, and we also measure the air pressure in pressure cookers and tires of vehicles. In the future kilopascals will be used as the unit of measure in these cases. The symbol for kilopascal is kPa.**

The unit we will use for measuring pressure is the _____

We have used the prefixes kilo, centi, and milli many times in these sections. There are additional prefixes that we will not use as often. You may find it helpful to know:

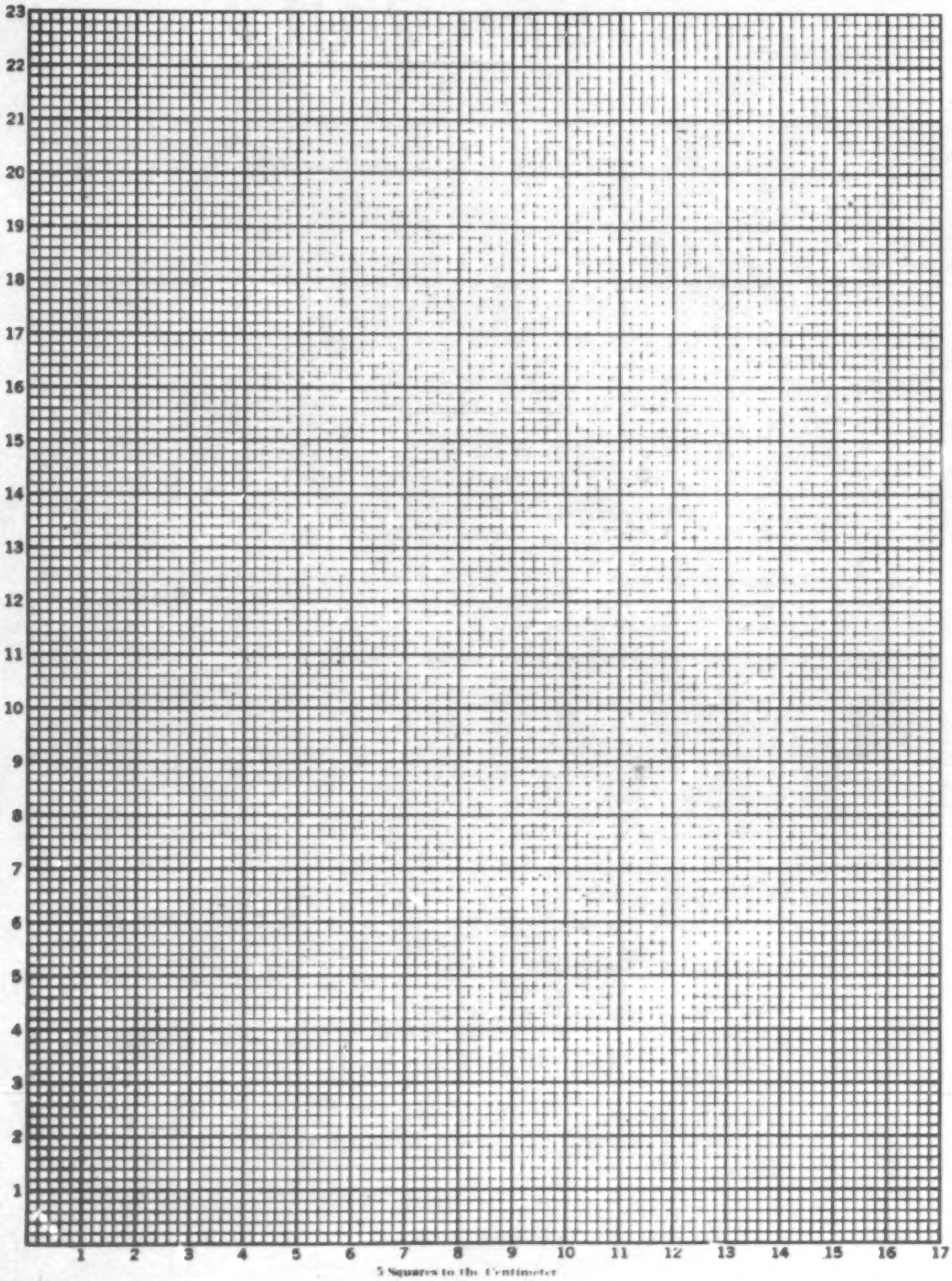
***deka* indicates 10 and its symbol is da**
***deci* indicates 0.1 and its symbol is d**
***hecto* indicates 100 and its symbol is h**
***mega* indicates 1 000 000 and its symbol is M**
***micro* indicates 0.000 001 and its symbol is μ**

TURN THE PAGE UPSIDE DOWN ONE MORE TIME

OTHER UNITS ANSWERS

1. second
2. joule
3. power
4. kilopascal

APPENDIX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5 Squares to the Centimeter

Boys
Height 4' to 4'10"
122cm to 147cm
Young, growing boy just beginning to mature.

Teen Boys
Height 5'1" to 5'8"
155cm to 173cm
Youthful build with shoulders and hips not as developed as those of a man.

Men
Height 5'10"
178cm
Adult male figure with fully developed shoulders, hips and neck.

Size	7	8	10	12	14	16	18	20	34	36	38	40	42	44	46	48	
Chest	26	27	28	30	32	33½	35	36½	34	36	38	40	42	44	46	48	in.
	66	69	71	76	81	85	89	93	87	92	97	102	107	112	117	122	cm
Waist	23	24	25	26	27	28	29	30	28	30	32	34	36	39	42	44	in.
	58	61	64	66	69	71	74	76	71	76	81	87	92	99	107	112	cm
Hip (Seat)	27	28	29½	31	32½	34	35½	37	35	37	39	41	43	45	47	49	in.
	69	71	75	79	83	87	90	94	89	94	99	104	109	114	119	124	cm
Neckband	11½	12	12½	13	13½	14	14½	15	14	14½	15	15½	16	16½	17	17½	in.
	30	31	32	33	34.5	35.5	37	38	35.5	37	38	39.5	40.5	42	43	44.5	cm
Shirt Sleeve									32	32	33	33	34	34	35	35	in.
									81	81	84	84	87	87	89	89	cm

Metric Size Charts courtesy of The McCall Pattern Company.

Girls

No defined bustline • Short Waist Length
Very young figure, not yet developing.

Size	7	8	10	12	14	
Breast	26	27	28½	30	32	in.
	66	69	73	76	81	cm
Waist	23	23½	24½	25½	26½	in.
	58	60	62	65	67	cm
Hip	27	28	30	32	34	in.
	69	71	76	81	87	cm
Back Waist Length	11½	12	12¾	13½	14¼	in.
	29.5	31	32.5	34.5	36	cm
Approx. Heights	50	52	56	58½	61	in.
	127	132	142	149	155	cm

Young Junior/Teen

Height 5'1" to 5'3"
155cm to 160cm

High Bust Position • Short Waist Length
Young, developing, pre-teen and teen figure.
Bust smaller in proportion to waist.

Size	5/6	7/8	9/10	11/12	13/14	15/16	
Bust	28	29	30½	32	33½	35	in.
	71	74	78	81	85	89	cm
Waist	22	23	24	25	26	27	in.
	56	58	61	64	66	69	cm
Hip	31	32	33½	35	36½	38	in.
	79	81	85	89	93	97	cm
Back Waist Length	13½	14	14½	15	15¾	15¾	in.
	34.5	35.5	37	38	39	40	cm

Junior Petite

Height 5' to 5'1"
152cm to 155 cm

Average Bust Position • Short Waist Length
Short, fully-developed figure.

Size	3jp	5jp	7jp	9jp	11jp	13jp	
Bust	30	31	32	33	34	35	in.
	76	79	81	84	87	89	cm
Waist	22	23	24	25	26	27	in.
	56	58	61	64	66	69	cm
Hip	31	32	33	34	35	36	in.
	79	81	84	87	89	92	cm
Back Waist Length	14	14¼	14½	14¾	15	15¼	in.
	35.5	36	37	37.5	38	39	cm

Junior

Height 5'4" to 5'5"
163 cm to 165 cm

High Bust Position • Short Waist Length
Short, fully-developed figure.

Size	5	7	9	11	13	15	
Bust	30	31	32	33½	35	37	in.
	76	79	81	85	89	94	cm
Waist	22½	23½	24½	25½	27	29	in.
	57	60	62	65	69	74	cm
Hip	32	33	34	35½	37	39	in.
	81	84	87	90	94	99	cm
Back Waist Length	15	15¼	15½	15¾	16	16¼	in.
	38	39	39.5	40	40.5	41.5	cm

Miss Petite

Height 5'2" to 5'3"
157cm to 160cm

Average Bust Position • Short Waist Length
Fully-developed, but shorter Misses figure with slightly larger waist measurement.

Size	6mp	8mp	10mp	12mp	14mp	16mp	
Bust	30½	31½	32½	34	36	38	in.
	78	80	83	87	92	97	cm
Waist	23½	24½	25½	27	28½	30½	in.
	60	62	65	69	73	78	cm
Hip	32½	33½	34½	36	38	40	in.
	83	85	88	92	97	102	cm
Back Waist Length	14½	14¾	15	15¼	15½	15¾	in.
	37	37.5	38	39	39.5	40	cm

Misses

Height 5'5" to 5'6"
165cm to 168cm

Average Bust Position • Average Waist Length
Fully-developed, well-proportioned figure, considered to be the "average" figure, also the tallest.

	6	8	10	12	14	16	18	20	
Bust	30½	31½	32½	34	36	38	40	42	in.
	78	80	83	87	92	97	102	107	cm
Waist	23	24	25	26½	28	30	32	34	in.
	58	61	64	67	71	76	81	87	cm
Hip	32½	33½	34½	36	38	40	42	44	in.
	83	85	88	92	97	102	107	112	cm
Back Waist Length	15½	15¾	16	16¼	16½	16¾	17	17¼	in.
	39.5	40	40.5	41.5	42	42.5	43	44	cm

Half-Size

Height 5'2" to 5'3" • 157cm to 160cm
Low Bust Position • Short Waist Length

Short, fully-developed figure with narrow shoulders.
Bust is smaller in porportion to waist and hips.

	10½	12½	14½	16½	18½	20½	22½	24½	
Bust	33	35	37	39	41	43	45	47	in.
	84	89	94	99	104	109	114	119	cm
Waist	27	29	31	33	35	37½	40	42½	in.
	69	74	79	84	89	96	102	108	cm
Hip	35	37	39	41	43	45½	48	50½	in.
	89	94	99	104	109	116	122	128	cm
Back Waist Length	15	15¼	15½	15¾	15⅞	16	16⅛	16¼	in.
	38	39	39.5	40	40.5	40.5	41	41.5	cm

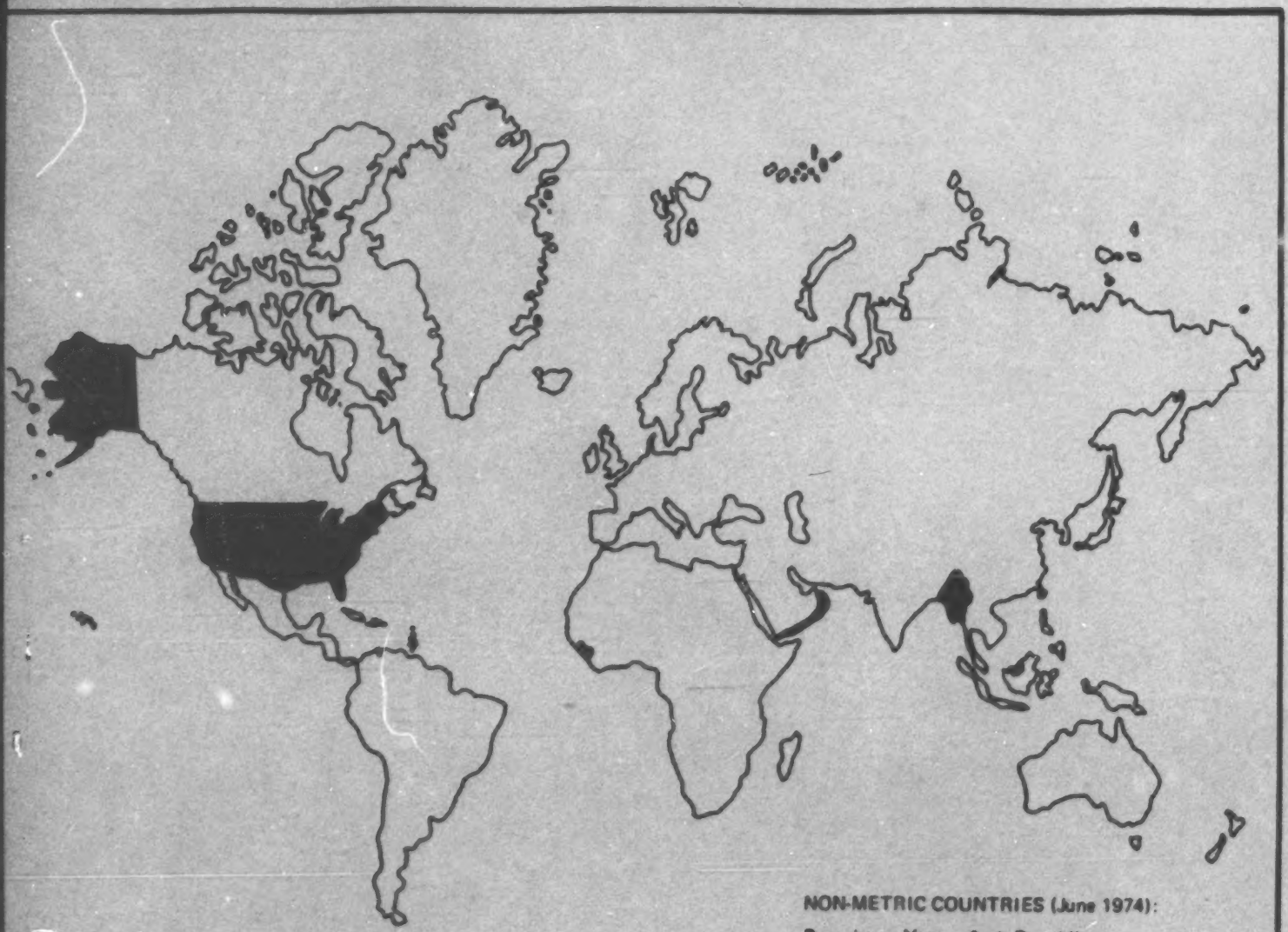
Women

Height 5'5" to 5'6" • 165cm to 168cm
Average Bust Position • Average Waist Length

Proportionately larger, more mature figure with slightly longer back waist length measurement due to fuller back.

	38	40	42	44	46	48	50	
	42	44	46	48	50	52	54	in.
	107	112	117	122	127	132	137	cm
	35	37	39	41½	44	46½	49	in.
	89	94	99	105	112	118	124	cm
	44	46	48	50	52	54	56	in.
	112	117	122	127	132	137	142	cm
	17¼	17⅜	17½	17⅝	17¾	17⅞	18	in.
	44	44	44.5	45	45	45.5	46	cm

ISLANDS IN A METRIC WORLD



NON-METRIC COUNTRIES (June 1974):

Brunei	Yemen Arab Republic
Burma	Yemen Peoples Democratic Republic
Liberia	United States

Map courtesy of Valerie Antoine,
Vice President, Metric Association